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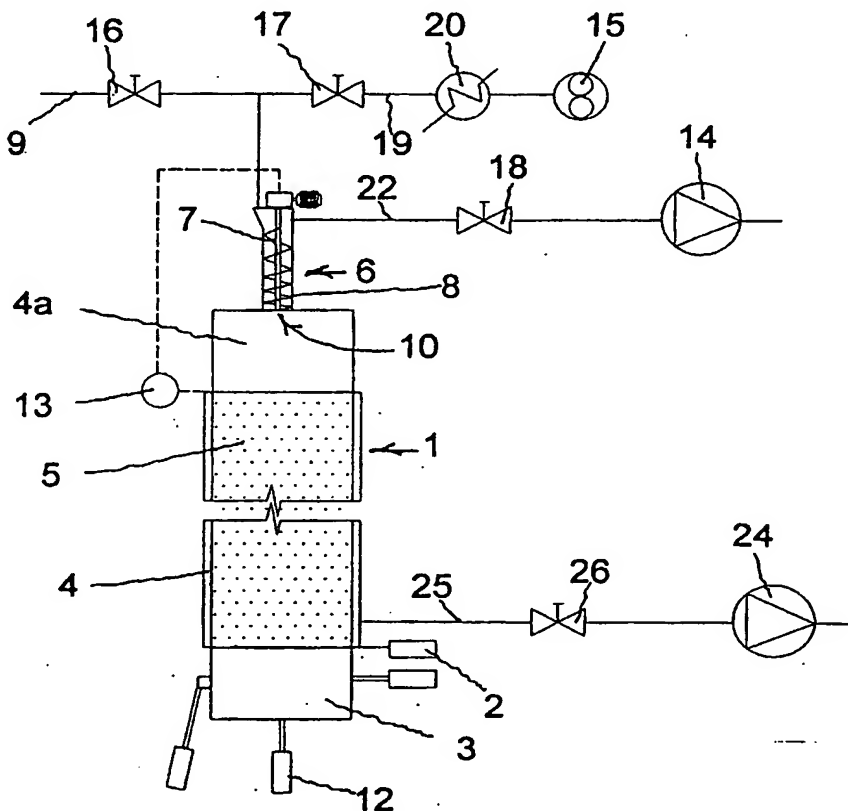
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With international search report.

(54) Title: A CHEESE TOWER INCORPORATING A PRESSURISED CURD INLET

(57) Abstract

Curd is fed to the top of tower (1), accumulates therein and is severed from the bottom as blocks by guillotine (2). During accumulation the weight of the pillar of curd (assisted by vacuum in chamber (4)) causes whey to be expressed therefrom via perforations (5). The throughput of tower (1) can be increased by pressure feeding the curd using auger (7). Alternatively pressurised feed may be achieved by air pressure from pump (15). The air may be heated by heat exchanger (20) to 20–25 °C to reduce friction of curd with inlet (6) and with tower (1). Warmed air may also be introduced into chamber (4).



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TITLE: A CHEESE TOWER INCORPORATING A PRESSURISED CURD INLET.

TECHNICAL FIELD OF THE INVENTION

This invention relates to cheese towers wherein a perforated column is charged with curd and the whey expelled from the curd through the perforations. The whey drains into a surrounding
5 chamber primarily owing to the weight of the pillar of curd. Vacuum is often cyclically applied to assist the drainage. At a lower end of the tower a guillotine is provided to sever blocks of cheese from the pillar of cheese curd that forms within the column. An associated cheese block forming apparatus completes the processing of the curd into cheese blocks.

BACKGROUND OF THE INVENTION

10 Many variations and improved forms of such cheese tower are known. These improvements are often directed at increasing the throughput of the apparatus without compromising the integrity of the final product. Further, traditionally several of these towers are grouped together as an installation, the towers being fed from a common curd supply and otherwise
15 operating together. For various reasons this grouping of the towers can compound the throughput verses integrity problem mentioned above. One of these reasons is that an interrupted supply may occur to one or more of the tower. This "starving" of a tower can detrimentally alter the consistency and residency time of a curd pillar forming in the column.

An intention of this invention is to provide a modification to a tower which it is envisaged will assist in meeting the desired requirements of a cheese tower in alleviating the problems as
20 mentioned above. A further intention is to provide the public with a useful choice.

DISCLOSURE OF THE INVENTION

According to a first aspect of this invention there is provided a cheese tower incorporating a perforated curd processing column therein with a whey drainage chamber about the perforations, a vacuum being created in the chamber to assist extraction of whey from curd
25 within the column, characterised in that a curd inlet to the column incorporates means to provide, at least at intervals, a pressurised feed of curd thereto.

According to a second aspect of this invention there is provided a cheese tower as described in the preceding paragraph wherein the column includes an imperforate section between the drainage section thereof and the pressurising means.

According to a third aspect of this invention there is provided a cheese tower as described in
5 either of the two immediately preceding paragraphs wherein the inlet thereto incorporates a prime mover rotatable auger within an adjacently surrounding housing, enclosed except for an entry to and exit therefrom, to provide the pressurised feed of curd to the column, the exit of the housing joining to the column.

According to a fourth aspect of this invention there is provided a cheese tower as described in
10 the preceding paragraph wherein the auger is mounted at the top of the column with the axis of rotation of the auger substantially in alignment with the longitudinal axis of the column.

According to a fifth aspect of this invention there is provided a cheese tower as described in either of the first two aspects of this invention wherein means are provided to provide, air at a pressure greater than prevails in the column, to curd within the inlet to tend to force curd in the
15 inlet into the column.

According to a sixth aspect of this invention there is provided a cheese tower incorporating a perforated curd processing column therein with a whey drainage chamber about the perforations, a vacuum being created at intervals in the chamber to assist extraction of whey from curd within the column characterised in that a curd inlet to the column incorporates means
20 to provide, at intervals corresponding to the intervals at which vacuum is not being created in the drainage chamber, a pressurised feed of curd thereto

According to a seventh aspect of this invention there is provided a cheese tower incorporating a perforated curd processing column therein with a whey drainage chamber about the perforations, a vacuum being created in the chamber to assist extraction of whey from curd
25 within the column characterised in that air, heated to a temperature greater than the surrounding ambient temperature, is applied to the curd.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic and fragmented side view of a first embodiment of the tower,

Figure 2 is the same view as Fig.1 depicting alternative embodiments,

Figure 3 is the same view as Fig.1 depicting further alternative embodiments,

5 Figure 4 is the same view as Fig.1 depicting even further alternative embodiments,

BEST MODES OF CARRYING OUT THE INVENTION

Referring in particular to Fig. 1, in known manner a tower 1 preferably has a guillotine 2 and block forming apparatus 3 at a lower end thereof. Following severing of a cheese block and the withdrawal of the guillotine 2 from a pillar of cheese formed within a column 4 of the tower 1
10 the block forming apparatus 3 lowers the severed block, such as by ram 12. With retraction of the guillotine 2 the curd pillar lowers, under its own weight, within the column 4. The column 4, which preferably widens from top to toe also preferably has the perforations 5 reducing in number and bore size toward the toe or lower end thereof. A curd supply is provided by line 9 and a vacuum pump 14 on line 22 draws curd therethrough. Valves 16 and 18 control lines 9
15 and 22 respectively. Vacuum is supplied to drainage chamber 4 from vacuum pump 24 via line 25. Valve 26 controls line 25.

Preferably an imperforate section 4a is provided at the top of the column 4 to provide a seal as discussed below. In accordance with this invention, an input 6 for curd is provided at a top of the tower 1 and means are provided to pressurise the supply of curd, indicated by line 9, within
20 input 6, to tend to force curd within the inlet 6 into column 4. Preferably the pressurising means comprises an auger 7 controlled to provide either a continuous or intermittent pressurised supply of curd. Auger 7 is mounted within an enclosure housing 8 with a close working tolerance therebetween and positioned to provide a pressurised feed of curd into and within the column 4. Curd entry 9 is provided adjacent the end of the housing 8 distal the

column 4 and an exit 10 joins the housing 8 to the column 4. A prime mover such as an electric motor 11 is provided to rotate, as required, the auger 7.

The action of the auger 7 will increase the throughput of the tower 1 by increasing the pressure acting on a pillar of curd within the column 4. Further, by the auger 7 providing either an intermittent or a continuous pressure on a curd pillar a positive force will be provided to assist displacement of the curd pillar downwardly following severing of a block therefrom.

Preferably the imperforate section 4a of the column 4 is contiguous with the housing 8 and associated auger 7. In operation a transient plug of curd is formed in section 4a with incoming curd being contained by the wall of section 4a and being compressed against the top of the pillar of curd therebeneath. This facilitates sealing between the input 6 and the perforated column 4 thus maintaining pressure within the column 4. Preferably sensors 13 are provided to monitor the pressure in the column 4 particularly adjacent the feed from the auger 7. The sensors 13 provide a feedback to the prime mover 11 to control the auger 7. In this manner a required pressure acting on the curd within input 6 and within the column 4 can be maintained. Preferably auger 7 is mounted on the top of a tower 1 with its axis of rotation in alignment with the longitudinal axis of the tower 1. Auger 7 may be a single or twin screw and of variable pitch.

Referring to Fig. 2, in a first alternative pneumatic embodiment is described. (While auger 7 and housing 8 are depicted they are not required with this embodiment.) This embodiment includes an air pump 15 that provides, as required, a pressure to curd in supply line 9 as it enters inlet 6. Pump 15 is connected to inlet 6 by line 19 controlled by valve 17. When transport of curd is required via inlet 6 to column 4 valves 16 and 18 are open and valve 17 closed. When it is required to apply pressure to curd within inlet 6 valves 16 and 18 are closed and valve 17 opened. Pump 15 is operated to tend to force curd within the inlet 6 into column 4.

Still referring to Fig. 2, in another embodiment means are provided to warm the curd with the inlet 6 and at least the joining section, such as imperforate section 4a, of the column 4. As

depicted in Fig. 2 preferably a heat exchanger 20 is provided to operate with pump 15 to provide that air supplied therefrom can be heated. Preferably the air is heated to be marginally warmer than the surrounding ambient temperature. Typically the air is warmed to 20C-25C while the ambient temperature may be as low 12C. It is found this reduces the frictional contact between the curd entering the column 4 and the containing walls thereof as well as the wall of inlet 6. It will be appreciated that this embodiment can also be operate with the auger 7 embodiment of the invention, the pressure from pump 15 being merely sufficient to supply the heated air to inlet 6.

Referring to Fig. 3, in an alternative embodiment a pump 15a and associated heat exchanger 20a are coupled via line 19a to curd supply such as vat 21 coupled to supply a multi-tower installation indicated by lines 9a. Operation is as aforesaid but with valve 16 controlling both the curd supply and the pressurised air supply heated or otherwise. Transport air is exhausted through line 22 controlled by valve 18.

Referring to Fig 4, a further heated air embodiment is depicted which may be utilised with either the pressurised curd supply embodiments described above or with known towers. The column 4 has a supply of heated, air such as aforesaid, fed thereto via line 19b by pump 15b in conjunction with heat exchanger 20b. A valve 17b operates in unison with a valve 23 to isolate the heated air supply from the column 4 when required.

CLAIMS:

1. A cheese tower incorporating a perforated curd processing column therein with a whey drainage chamber about the perforations, a vacuum being created in the chamber to assist extraction of whey from curd within the column, characterised in that a curd inlet to the column
5 incorporates means to provide, at least at intervals, a pressurised feed of curd thereto.
2. A cheese tower as claimed in claim 1 wherein the column includes an imperforate section between the drainage section thereof and the pressurising means.
3. A cheese tower as claimed in either claim 1 or claim 2 wherein the inlet thereto incorporates a prime mover rotatable auger within an adjacently surrounding housing, enclosed
10 except for an entry to and exit therefrom, to provide the pressurised feed of curd to the column, the exit of the housing joining to the column.
4. A cheese tower as claimed in claim 3 wherein the auger is mounted at the top of the column with the axis of rotation of the auger substantially in alignment with the longitudinal axis of the column.
- 15 5. A cheese tower as claimed in claim 1 or claim 2 wherein the pressurised means are provided by a pump to supply air, at a pressure greater than prevails in the column, to curd within the inlet to tend to force curd in the inlet into the column.
6. A cheese tower incorporating a perforated curd processing column therein with a whey drainage chamber about the perforations, a vacuum being created at intervals in the chamber to
20 assist extraction of whey from curd within the column characterised in that a curd inlet to the column incorporates means to provide, at intervals corresponding to the intervals at which vacuum is nor being created in the drainage chamber, a pressurised feed of curd thereto.

7. A cheese tower as claimed in either claim 5 or claim 6 wherein the pressurised air supply is fed to the inlet via a branch line from the curd supply line, controls being provided to isolate the curd supply from the inlet when the pressurised air supply is operating.

8. A cheese tower incorporating a perforated curd processing column therein with a whey drainage chamber about the perforations, a vacuum being created in the chamber to assist extraction of whey from curd within the column characterised in that air, heated to a temperature marginally greater than the surrounding ambient temperature, is applied to the curd.

9. A cheese tower as claimed in claim 8 wherein the heated air is provided by a heat exchanger and an associated air pump coupled to the inlet and/or the column.

10. A cheese tower as claimed in any one of the claims 1 to 7 inclusive wherein sensors are provided to monitor the pressure at the inlet and joining section of the column and provide feedback to the pressurising means.

11. A multi-tower cheese tower installation comprising a plurality of towers as claimed in claim either claim 5 or claim 6 wherein the towers are fed from a common supply and wherein the common supply is pressurised to provide the individual pressurised supply to each tower.

12. A multi-tower cheese tower installation as claimed in claim 11 wherein the pressurised air is heated to a temperature marginally greater than the surrounding ambient temperature.

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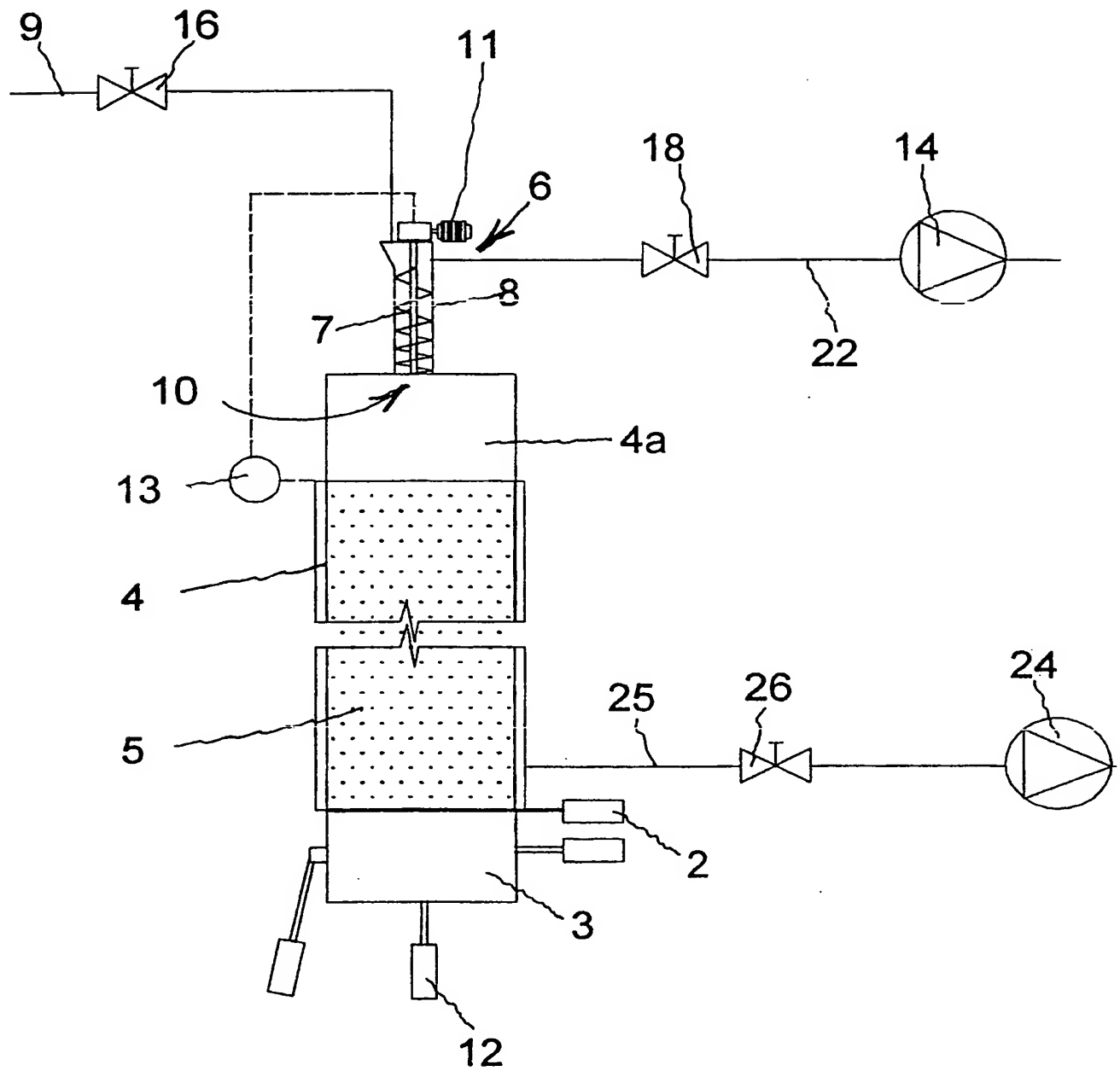


Figure 1

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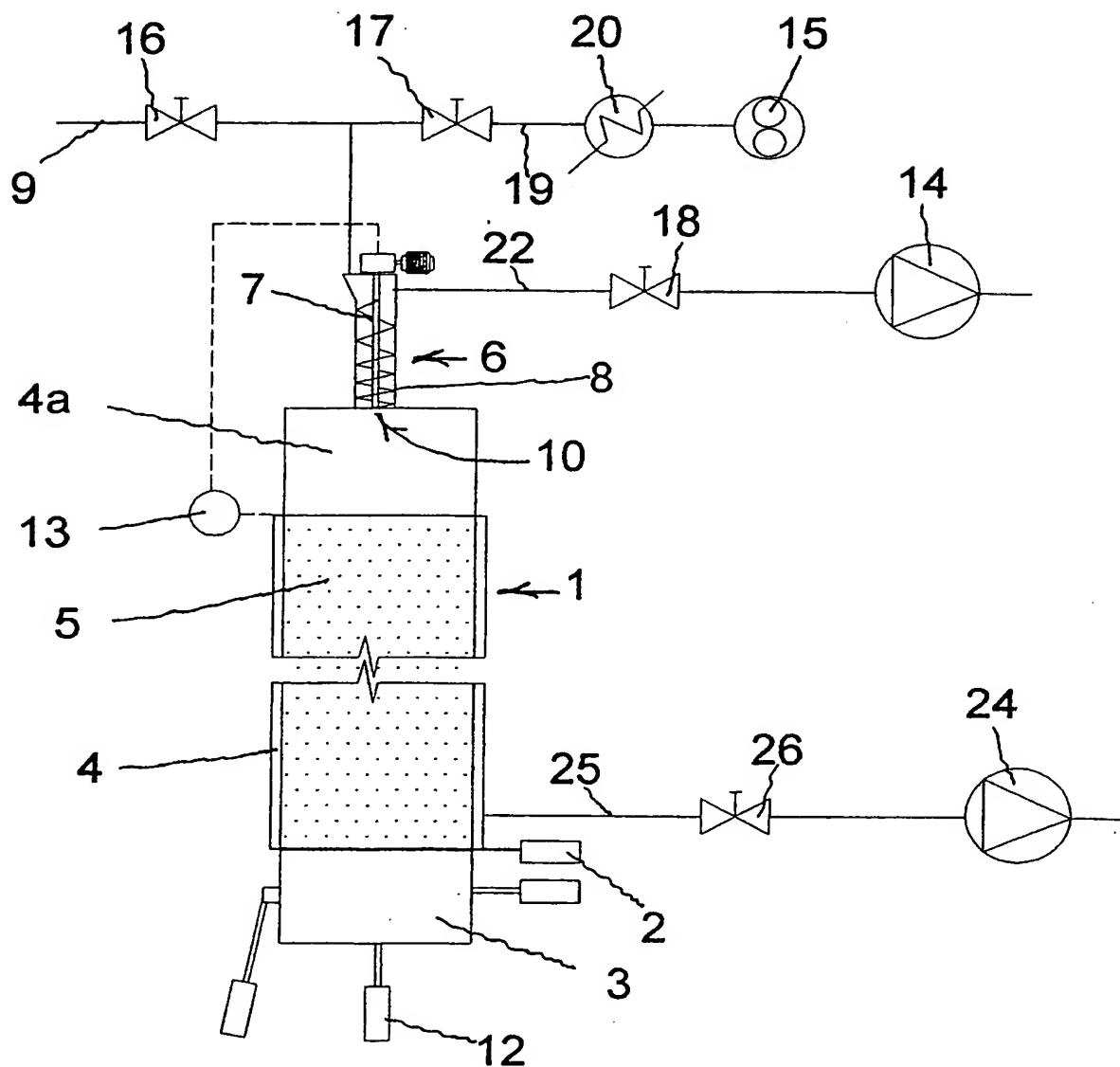


Figure 2

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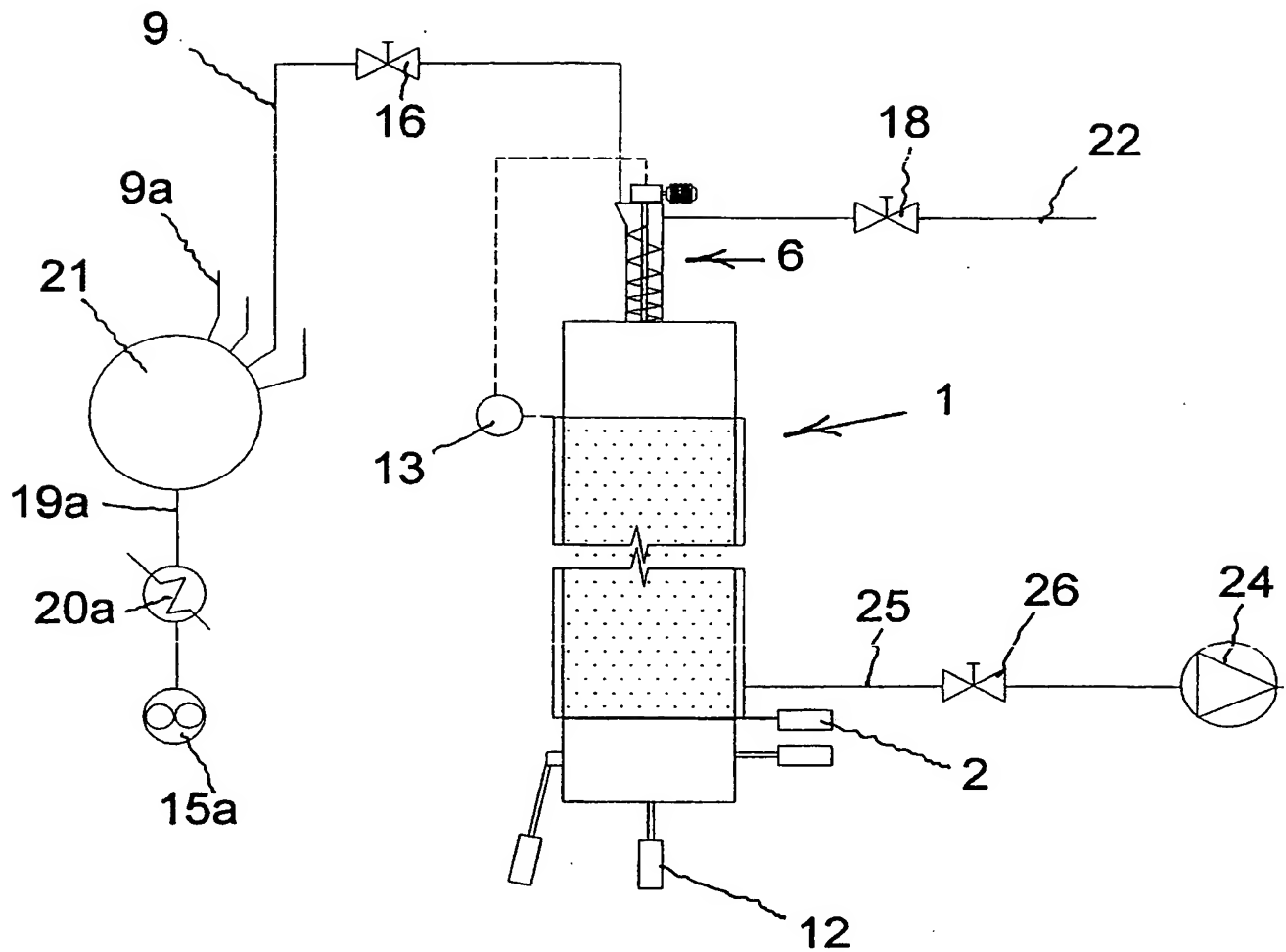


Figure 3

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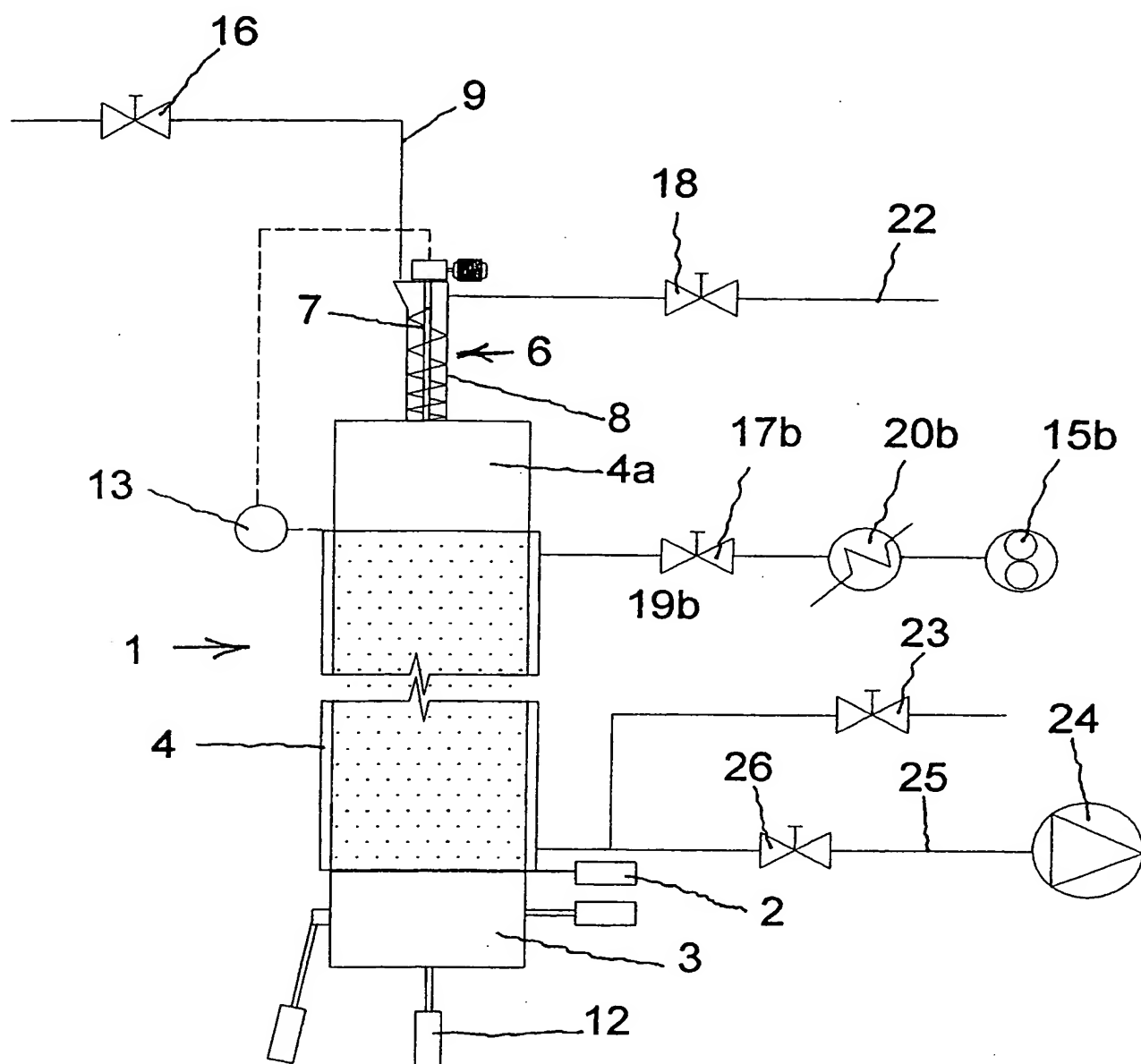


Figure 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ 00/00023**A. CLASSIFICATION OF SUBJECT MATTER**Int. Cl. ⁷: A01J 25/11, 25/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHEDMinimum documentation searched (classification system followed by classification symbols)
A01J 25/-, A23C 19/- USING KEYWORDSDocumentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU: IPC AS ABOVEElectronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT: A01J 25/-, A23C 19/- using keywords**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent Abstract Accession No. 88-211323/30, Class P13, SU 1364254 A (STAVROPOL POLY) 7 January 1988	1, 3- 4
X	EP 0818140 A (TETRA PAK TEBEL B V) 14 January 1998 See whole document, but in particular lines 14-20 of column 4 and lines 47-52 of column 5.	1-2, 5-6, 11
X	GB 1542844 A (WINCANTON ENGINEERING LIMITED) 28 March 1979 See whole document, but in particular lines 88-93 of page 4.	1, 5

☐ Further documents are listed in the continuation of Box C
 ☒ See patent family annex

* Special categories of cited documents:

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Date of the actual completion of the international search
30 May 2000

Date of mailing of the international search report

19 JUN 2000

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ 00/00023

Box 1 Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos :
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos :
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos :
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box II Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claims 1-7, 10-12 directed to a cheese tower using vacuum assisted extraction of whey and where the curd is fed to the tower under pressure,
 2. Claims 8-9 directed to a cheese tower using vacuum assisted extraction of whey and where warm air is applied to the curd,
as reasoned on the extra sheet.
1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
 2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
 3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
 4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NZ 00/00023

Supplemental Box

(To be used when the space in any of Boxes I to VIII is not sufficient)

Continuation of Box No: II

1. Claims 1-7, 10-12 are directed to a cheese tower having a perforated column with a surrounding chamber to which vacuum is applied to assist extraction of whey and where the curd is fed to the column under pressure. It is considered that the feeding of curd to the column under pressure comprises a first "special technical feature".

2. Claims 8-9 are directed to a cheese tower having a perforated column with a surrounding chamber to which vacuum is applied to assist extraction of whey and where the curd has warm air applied thereto. It is considered that applying warm air to the curd comprises a second "special technical feature".

Since the above groups of claims do not share either of the technical features identified, a "technical relationship" between the inventions, as defined in PCT rule 13.2 does not exist. Accordingly the international application does not relate to one invention or to a single inventive concept.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/NZ 00/00023

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
EP	818140	AU	28504/97	BR	9703909	CA	2209547
		JP	10056897	NO	973168	NZ	328267
GB	1542844	AU	12572/76	BE	840192	DE	2612938
		SE	7603799	ZA	7602006		
END OF ANNEX							